storm-energy, the southwestern depression uniting with others from the northwest and moving northeastward, with severe gales on the lakes. Preceding this outbreak, and during marked solar activity at the site where the sun spots appeared on the 14th, there had been on the 11th, 12th and 13th considerable agitation of the suspended magnet. On these dates and on October 10th the formation of clouds, moving in distinct layers and with different velocities, had been strongly marked, cumulus being surmounted by long streamers of cirrus, radiating from points toward the west and northwest. From October 3d onward there had not been a day on which cirrus or high stratus had not been observed. On October 4th, 6th, and 7th there was also at some time during the day underlying cumulus or scud.

The rapid formation of spots in the sun's eastern quadrant on October 14th, whilst remaining portions of the sun's surface were almost entirely free from disturbance, nearly fulfills the conditions mentioned in my last communication in regard to the occurrence of a "cold wave" of energetic character and wide extent, when a disturbed portion of the sun has come into view, following a portion comparatively calm. It seems to be a general rule that a single energetic disturbance upon the solar surface has a much more marked and distinguishable influence upon atmospheric conditions than has a succession of such disturbances.

It will be understood that in presenting these points as bearing upon the causes of general atmospheric perturbations with incidental local storms the writer regards them as of a tentative nature. Although he has given some attention to these matters for seven or eight years past he is not fully satisfied as to the possibility of tracing out satisfactorily the influence of cosmical agencies as affecting the weather in individual instances. Coincidences of the character indicated in these notes constitute valid proof only when sufficiently multiplied.

WATER-SPOUTS.

Capt. Chas. Acocks, commanding the bark "Mary," on the 6th, in N. 34° 42′, W. 74° 43′ (*at noon*), saw a large water-spout in the morning.

The bark "Julius," on the 8th, at 10 p. m., in N. 20° 52′, W. 83° 50′, was struck forward by a water-spout, lasting only three minutes, which knocked one of the crew on lookout from forecastle to lower deck, and, passing around port side of vessel, went clear without causing any damage.

Capt. Samuel Hess, commanding the s. s. "Philadelphia," gives the following interesting description of a water-spout: "October 16th, at 3 p. m., civil time, in N. 27° 34′, W. 69° 48′, observed a most remarkable and well-defined water-spout; computed height, or length of spiral column of water, from observations by sextant, sixteen hundred feet; elapsed time from beginning to end, forty-five minutes; movement northwest. The weather was fine, with light airs from northeast. After the spout broke the clouds suddenly spread themselves overhead, and heavy showers of rain fell for half an hour, accompanied with fresh breezes from southeast."

VERIFICATIONS.

INDICATIONS.

The indications for October, 1886, were made by 2d Lieutentant J. E. Maxfield, Signal Corps, U. S. Army, Assistant, and were verified by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant.

The detailed comparison of the tri-daily indications for October, 1886, with the telegraphic reports during the twenty-four hours for which the indications were prepared, shows the general average percentage of verifications to be 81.51. The percentages for the different elements are: Weather, 85.29; wind, 73.39; temperature, 78.82. By states, etc., the percentages are: For Maine, 77.26; New Hampshire, 77.12; Vermont, 78.04; Massachusetts, 76.85; Rhode Island, 76.29; Connecticut, 79.69; New York, 81.45; Pennsylvania, 80.22; New Jersey, 81.18; Delaware, 80.62; Maryland, 81.77; District of Columbia, 79.73; Virginia, 80.99; North Carolina, 88.18; South Carolina, 85.51; Georgia, 87.98; Florida, 85.37; Alabama, 87.58; Mississippi, 84.75; Louisiana, 86.02; Texas, 88.76; Arkansas, 84.30; Tennessee, 84.78; Kentucky, 85.83; Ohio, 84.48; West Virginia, 79.06; Indiana, 84.86; Illinois, 84.50; Michigan, 83.09; Wisconsin, 75.48; Minnesota, 76.10; Iowa, 74.18; Kansas, 76.13; Nebraska, 73.71; Missouri, 82.35; Colorado, 73.47; east Dakota, 72.02.

There were ten omissions to predict, out of 9,951, or 0.10 per cent. Of the 9,941 predictions that have been made, five hundred and one, or 5.04 per cent., are considered to have entirely failed; four hundred and thirty-nine, or 4.42 per cent., were one-fourth verified; 1,589, or 15.98 per cent., were one-half verified; 1,793, or 18.04 per cent., were three-fourths verified; 5,619, or 56.52 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

In the table below are shown for the Pacific coast the percentages of indications for the months of July, August, and September, 1886. The indications for the three months were made by 2d Lieutenant W. A. Glassford, Signal Corps, U. S. Army, Assistant; those for July and September were verified by 2d Lieutenant J. E. Maxfield, Signal Corps, U. S. Army, Assistant; those for August were verified by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant:

Percentages of indications verified.

Districts.	July.	August.	September.
Washington Territory	84.30	79.62	83.49
Oregon	84.12	82.39	84.60
Northern California	90.91	83.25	92.14
Southern California	89.06	84.21	92.14

CAUTIONARY SIGNALS.

During October, 1886, the total number of signals ordered of all kinds, the verifications of which were determined, was one hundred and fifteen, of these, sixty-two, or 53.91 per cent., were fully verified both as to direction and velocity. Of the above, fifteen were ordered for on-shore winds, number verified, eleven, or 73.33 per cent.; three were ordered for northeasterly winds, number verified, none; twelve were ordered for southwesterly winds, number verified, three, or 25.00 per cent.; eight were ordered for northwesterly winds, number verified both as to direction and velocity, five, or 62.50 per cent., verified as to velocity only, one, or 12.50 per cent.; seventy-seven were ordered for winds without regard to direction, number verified, forty-three, or 55.84 per cent.; four, or 3.50 per cent., were ordered late, *i. e.*, after the verifying velocity had begun.

In twenty-one cases winds occurred which would have justified the display of cautionary signals but for which they were not ordered, and in fifteen instances winds which would have justified the display of on-shore signals, but for which they were not ordered.

In addition to the above, two hundred and eighteen signals were ordered at display stations, the verification of which it was impracticable to determine.

COLD-WAVE SIGNALS.

During October, 1886, the total number of cold-wave signals ordered, the verifications of which were determined, was ninety-three; number verified, fifty-six, or 60.22 per cent. Twenty signals were ordered, the verifications of which it was impracticable to determine. In addition to the above, in one hundred and forty-four instances, the signals ordered from this office were repeated by the observers at the regular stations to towns in their vicinity. The verification of these it was impracticable to determine.

RAILWAY WEATHER SIGNALS.

P. H. Mell, jr., director of the "Alabama Weather Service," in the report for October, 1886, states:

The verification of predictions for the whole area was 97 per cent. for temperature, and 96 per cent. for weather.

The following corporations comprise this system: South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia system in Alabama; Memphis and Charleston; Columbus and Western; Atlanta and West Point of Georgia; Northeastern of Georgia; Western and Atlantic; East Tennessee, Virginia and Georgia system in Georgia; Montgomery and Eufaula; Pensacola and Selma; Pensacola and Atlantic; the cities of Milledgeville, Georgia, and Talladega, Alabama.

J. D. Plunkett, M. D., President of the Tennessee Board of Health, in the bulletin for October, 1886, states:

The percentage of verifications of weather predictions as telegraphed from the Signal Office at Washington, and displayed by signal flags at various stations in the state are: for temperature, 90°.3; for weather, 87°.6.

The following is from the "Bulletin of the New England Meteorological Society" for October, 1886:

Verification of weather signals at New Haven was 81 per cent. for temperature, 87° for weather; at seven stations reporting to the Boston Signal Office, 90° for temperature, 94° for weather.

ERRATUM.

In the "REVIEW" for September, 1886, on page 250, under "Deviations from normal temperatures," at Wytheville, Virginia, instead of "The mean temperature of the nine months, ending September 30th, 37°.6, is 4°.5 above the normal," read, the total precipitation of the nine months, ending September 30th, 37.56 inches, is 4.46 inches above the normal.

Meteorological record of voluntary observers and Army post surgeons, October, 1886.

The maximum and minimum temperatures at stations marked thus (*) are from readings of other than standard instruments.

Stations.	Temperature. Maximum.	Minimum.	Mean.	Rainfall.
	°	°	°	Inches
Alabama.				
Greensborough	78	41	67.4	1.59
Livingston	85	34	66.4	0.76
Mount Vernon B'ks.	91	35	69.2	0.00
Arizona.				
Huachuca, Fort	85	33	62.4	0.84
Lowell, Fort	97	32	68.8	0.12
McDowell, Fort	101	37	68.7	0.30
Arkansas.				
Lead Hill	88	24	58.3	0.10
British Columbia.				
New Westminster	68	34	48.4	5.28
California.				
Alcatraz Island	74	45	55.0	1.30
Angel Island	83	42	57.9	1.49
Benicia Barracks	81	44	59.6	1.46
Bidwell, Fort	76	25	47.0	1.93
Cahuenga				0.05
Gaston, Fort	83	24	53.8	3.36
Hydesville				3.06
Mason, Fort	71	48	57.0	1.02
Nicolaus	92	41	60.0	0.89
Oroville	87	43	62.2	0.63
Poway	83	40	57.0	0.10
Presidio of San F	74	42	55.4	0.44
Princeton				0.53
Sacramento	80	36	54.8	0.79
Salinas	69	39	52.5	0.62
Susanville	73	32	50.0	1.32
Colorado.				
Colorado Springs	76	22	50.6	0.28
Lewis, Fort	68	22	45.3	2.02
Connecticut.				
Bethel				2.32
North Colebrook	75	18	50.1	1.32
Voluntown	80	20		4.70
Dakota.				
Abr. Lincoln, Fort	85	17	47.8	0.80
Henry	81	24	50.3	1.06
Pembina, Fort	83	12	45.4	1.10
Randall, Fort	85	15	55.4	0.91
Richardton	80	24	45.1	0.80
Sisseton, Fort	80	19	49.1	1.00
Sully, Fort	91	23	52.6	0.45
Totten, Fort	82	19	46.9	1.38
Webster	85	20	51.1	1.77
Yates, Fort	85	10	48.6	0.70
District of Columbia.				
Distributing Res'r*	80	35	58.9	1.19
Kendall Green*	79	42	56.2	0.88
Receiving Res'v'r*	79	36	58.4	1.13
Rock Creek Bridge*	84	38	61.2	
Florida.				
Alva*	88	55	71.4	3.55
Archer*	92	38	72.7	2.11
Limona*	90	50	75.5	2.64
Merritt's Island	89	58	73.7	11.94
Manatee	93	53	75.0	3.90
Meade, Fort				2.54
Tallahassee	80	44	68.5	2.66
Georgia.				
Athens	84	33	61.3	0.01
Forsyth*	90	42	68.4	0.35
Milledgeville	83	34	64.0	trace
Quitman	83	41		0.30
Idaho.				
Boisé Barracks	87	27	53.0	0.42
Cœur d'Alone, Fort	77	25	45.0	2.05
Illinois.				
Anna*	83	34	61.1	0.74
Bloomington	78	30		0.78
Collinsville	82	31	58.1	0.78
Charleston*	88	30	56.6	0.74
Geneseo*	84	28	55.2	2.36
Mattoon*	86	32	60.0	1.05
Pekin*	86	27	57.1	1.38
Peoria	84	32	58.4	1.81
Riley	80	26	52.2	2.55
Rockford	80	27	52.2	4.03
Sandwich	84	29	54.5	1.65
South Evanston	84	25		1.46
Sycamore	81	27	50.6	2.26
Windsor	84	29	53.6	1.04
Indian Territory.				
Gibson, Fort	83	24	62.2	2.75
Reno, Fort	86	28	62 4	4.17
Supply, Fort	85	24	61.2	1.32

Stations.	Temperature. Maximum.	Minimum.	Mean.	Rainfall.
	°	°	°	Inches
Indiana.				
Butlerville*	85	32		1.68
Fort Wayne*	85	32	54.3	1.20
Jeffersonville	82	32	56.2	0.62
Laconia	84	30	55.7	0.55
Lafayette	85	28	53.5	0.73
La Grange	79	31	52.9	2.07
Logansport*	86	34	56.2	1.30
Manzy	79	23	46.5	1.10
Monticello	84	32	51.4	
Sunman*	78	29	54.3	1.22
Terre Haute*	79	32		0.21
Vevay	85	33	56.6	0.91
Iowa.				
Bancroft	84	20	54.0	0.48
Cedar Rapids a	82	22	53.6	4.92
Cedar Rapids b	85	18	52.5	5.06
Crosco	81	22	51.8	1.72
Clinton	86	24	52.7	4.29
Des Moines	86	23	50.9	
Independence*	78	29	52.7	3.60
Logan	88	22		3.80
Madison, Fort	82	30		3.40
Manchester*	85	25	54.9	8.15
Monticello*	86	23	53.0	5.34
Mount Vernon	88	27	56.7	
Muscatine	85	20		4.70
Oskaloosa*	85	27	56.0	3.20
Urbana	85	32	53.9	4.45
West Union	83	22	51.7	3.30
Kansas.				
Allison	94	17	57.2	0.12
Belleville				1.83
El Dorado	82	24	59.4	2.13
Elk Falls				1.62
Emporia	83	33	60.0	1.70
Globe	86	25	60.0	
Hays, Fort	83	16	58.4	1.44
Independence*	87	28	59.8	1.02
Manhattan a	88	22	58.5	2.25
Manhattan b	91	25	61.0	2.42
Riley, Fort	87	24	61.8	1.74
Sterling	82	32	57.7	2.00
Salina	80	42	62.4	2.03
Wellington	84	23	56.8	1.29
West Leavenworth	88	28		3.10
Westmoreland*	98	24	59.0	1.62
Wyandotte	88	24	60.3	1.45
Kentucky.				
Bowling Green	83	39		0.78
Frankfort	88	30	54.5	0.89
Richmond	81	32	56.4	0.78
Louisiana.				
Grand Coteau	90	43	66.9	2.73
Liberty Hill				2.17
Luling*	88	43		0.70
Maine.				
Cornish*	76	20	46.7	5.10
Gardiner	78	23	46.4	3.07
Kent's Hill	69	22	44.4	3.24
Orono*	75	21	45.5	1.42
Maryland.				
Cumberland	75	34	50.0	0.50
Fallston*	81	33	50.2	2.24
Great Falls*	80	32	56.0	2.31
McDonogh	77	31	57.1	1.52
McHenry, Fort	75	34	58.7	1.42
Woodstock	77	28	54.3	1.90
Massachusetts.				
Amherst a	78	17	48.9	2.97
Amherst b	76	24	49.7	3.06
Blue Hill Obs'y	77	25	49.5	4.87
Deerfield	78	20	49.8	3.72
Dudley	79	36	58.0	1.73
Fall River	76	26	51.1	4.59
Milton	76	20	48.2	3.89
New Bedford	76	24	51.8	4.49
North Truro				4.93
Princeton	75	22	47.7	2.97
Somerset*	81	24	52.9	3.82
Taunton	84	21	51.1	3.13
Worcester	73	34	48.0	2.75
Westborough	81	20	53.0	2.98
Williamstown	72	25	49.3	2.60
Michigan.				
Brady, Fort	78	23	47.4	5.69
Harrisville*	78	27		1.57

Meteorological record of voluntary observers, etc.—Continued.

Stations.	Temperature. Maximum.	Minimum.	Mean.	Rainfall.
	°	°	°	Inches
Michigan—Cont'd.				
Hudson	81	28		1.67
Kalamazoo	75	36	55.5	1.29
Lansing	79	31	51.8	1.15
Mottville	82	30	63.5	
Pentwater	83	10	50.7	3.58
Thornville	79	35	52.2	1.61
Traverse City	81	27		4.57
Minnesota.				
Minneapolis	81	24	52.0	0.46
Snelling, Fort	85	22	55.4	0.80
Missouri.				
Centreville	80	19		0.96
Central College*	82	27		1.99
Oregon	86	27	60.6	5.41
Montana.				
Assinaboine, Fort	82	22	46.3	0.11
Keogh, Fort	89	25	48.5	1.30
Missoula, Fort	72	21	43.8	0.58
Shaw, Fort	83	19	46.4	0.94
Nebraska.				
Brownville	88	31	60.5	4.37
Crete	87	21	57.0	0.71
De Soto*	90	23	57.7	2.74
Fairbury	93	42		1.93
Fremont*	85	24	56.5	0.95
Genoa	81	21	55.9	1.43
Lincoln	84	22	57.6	0.08
Hay Springs*	83	23	47.2	0.37
Marquette				0.14
Niobrara, Fort	85	18	51.7	0.26
Robinson, Fort	88	12	49.8	0.31
Sidney, Fort	79	21	49.4	0.40
Stockham				0.26
Nevada.				
Carson City	77	18	46.2	0.21
Halleck, Fort	78	18	42.6	2.36
McDermit, Fort	79	30	47.4	1.90
New Hampshire.				
Antrim				3.60
Ashland				3.53
Belmont				2.53
Berlin Mills	75	13		1.62
Bristol				3.28
Lake Village				3.02
Nashua	79	21	48.9	2.37
Wier's Bridge				3.58
Wolfborough				3.00
Woodstock				3.01
New Jersey.				
Beverly*	80	29	55.9	2.85
Clayton*	88	24	54.8	2.32
Dover*	83	21	49.5	2.02
Egg Harbor City	82	20	55.9	3.15
Moorestown	81	22	54.0	2.47
Readington*	82	30	58.5	1.80
Roseland				3.07
South Orange	78	28	54.3	2.40
Upper Montclair	79	20	55.2	3.40
Vineland	77	34	57.1	2.88
New Mexico.				
Bayard, Fort	82	39	58.4	1.60
Gallinas Spring	78	45		1.26
Selden, Fort	86	30	60.8	2.27
Union, Fort	75	27	51.3	0.90
Wingate, Fort	78	25	49.1	1.50
New York.				
Auburn	73	33	51.0	2.85
Brooklyn	78	32	55.4	3.40
Cooperstown*	72	29	48.0	2.54
David's Island		30	56.4	2.18
Factoryville*	77	24	49.0	1.85
Ithaca	75	24	50.6	2.28
Le Roy	77	24	49.8	1.74
Madison Barracks	71	26	50.0	1.44
Niagara, Fort	76	32	51.6	0.77
North Volney*	75	31	49.8	
Palermo*	79	31	47.4	1.85
Palmyra*	78	34	52.0	
Penn Yan				1.90
Plattsburg B'ks	72	20	47.6	0.76
Syracuse	78	31		
Setauket	76	31	55.5	4.15
White Plains	75	21	55.2	2.49
North Carolina.				
Chapel Hill	89	35	58.7	1.47
Flat Rock	75	34	53.0	0.17
Lenoir	80	35		1.00
Lincolnton	73	41	53.6	0.21
Raleigh	88	42	62.0	0.90
Reidsville*	89	30	55.2	0.55
Statesville*	78	37	56.9	0.30
Wake Forest	85	35	60.3	2.30
Weldon*	83	40	58.8	2.38
Ohio.				
Cleveland	80	35	53.6	0.74
College Hill*	93	36	55.8	1.25
Elyria	83	32	65.7?	1.31
Garrettsville	79	25	49.1	0.87
Hiram	78	30	53.0	1.28
Jacksonborough*	80	31	53.1	1.55
Napoleon	80	33	54.4	1.42

Stations.	Temperature. Maximum.	Minimum.	Mean.	Rainfall.
	°	°	°	Inches
Ohio—Cont'd.				
North Lewisburg	83	31	55.7	1.80
Portsmouth	80	35	53.5	1.25
Ruggles*	75	28	52.3	0.80
Tiffin*	81	31	50.1	1.23
Westerville	77	30	51.4	1.33
Wauseon	84	29	52.0	1.94
West Milton	85	30	54.0	3.00
Yellow Springs	74	30	52.6	1.46
Oregon.				
Albany*	77	30	51.3	3.28
Bandon*	62	32	47.0	5.87
Eola*	74	34	50.0	3.12
East Portland*	70	37		3.12
La Grande	80	28		1.49
Mount Angel*	73		50.0	
Pennsylvania.				
Altoona	80	30	54.9	0.74
Blooming Grove*	78	24		2.90
Bethlehem*	84	29	55.6	2.18
Catawissa*	80	27	53.2	2.84
Dyberry	75	22	49.0	2.42
Easton				2.37
Fallsington	80	29	53.6	2.90
Franklin*	72	28	44.7	1.20
Germantown*	79	33		2.71
Grampian Hills*	70	20	50.4	0.97
Mahanoy Plane	77	39	55.8	3.35
Phillipsburg*	62	26	43.0	1.70
Quakertown	70	24	53.3	2.65
Wellsborough*	75	30	51.2	1.88
West Chester	80	27	55.0	3.06
Wyson	74	32	53.0	2.21
York		34	68.8	0.91
Zionsville	84	32	61.4	2.71
South Carolina.				
Aiken	89	60	76.7	1.55
Kirkwood*	77	24	58.0	0.39
Pacolet	76	41	59.7	0.06
Spartanburg	75	48	61.7	0.06
Statesburg*	82	38	63.0	2.02
Tennessee.				
Ashwood	82	33	60.5	0.32
Milan	83	30	57.5	0.90
Texas.				
Austin*	89	42	69.1	0.25
Cleburne	86	29	68.0	0.37
Comfort				1.75
Concho, Fort	89	39	66.6	1.35
Corsicana				2.53
McIntosh, Fort	92	47	72.6	
Midland	85	44	64.0	0.76
Ringgold, Fort	96	44	76.1	trace
New Ulm	92	42	69.1	0.92
Silver Falls	82	42		3.44
Vermont.				
Brattleborough	79	18	49.5	4.14
Burlington	76	26	49.4	1.25
Charlotte*	76	30	42.8	1.50
Lunenburg	72	23	47.4	1.40
Newport	75	22	46.3	2.24
Post Mills*	76	16	43.0	1.85
Poultney	76	19	47.8	2.40
Strafford	73	20	49.0	2.03
Virginia.				
Accotink	81	33	55.4	0.99
Bird's Nest*	85	48	53.9	2.05
Bruington				1.83
Dale Enterprise*	88	32	61.3	2.54
Marion	78	34	54.0	0.63
Monroe, Fort	80	44	62.8	2.20
Rappahannock	85	36	62.3	1.00
Snowville	78	28		1.12
Summit	82	28	56.0	
University of Va	72	44	58.3	0.80
Variety Mills	81	30	52.8	1.07
Wytheville	77	29	52.9	0.87
Washington Territory.				
Bainbridge Island*	72	40	53.2	3.00
Kenewick	81	24		1.17
Spokane, Fort	83	22	48.9	0.58
Tacoma*	64	34	50.9	3 78
Townsend, Fort	68	33	49.5	2.61
Walla Walla, Fort	81	32	52.2	1.88
West Virginia.				
Clarksburg	72	28	53.0	0.80
Holvetia*	78	29	49.6	1.35
Parkersburg	80	35	52.8	0.83
Wisconsin.				
Beloit	80	27	52.3	2.60
Delavan	81	24	53.5	2.70
Embarras*	82	25	53.8	5.85
Fond du Lac*	82	20	51.0	1.97
Lancaster	84	24	52.8	
Madison	80	31	52.4	3.21
Manitowoc	72	29	54.1	3.86
Prairie du Chien	85	24	54.1	4.33
Wausau	77	21	49.5	3.21
Wyoming.				
Laramie, Fort	81	23	50.2	0.04